Computational Aeroacoustics Using the Generalized Lattice Boltzmann Equation, Phase I

Completed Technology Project (2006 - 2006)

Project Introduction

The overall objective of the proposed project is to develop a generalized lattice Boltzmann (GLB) approach as a potential computational aeroacoustics (CAA) tool for noise prediction thus contributing to NASA's goal of reducing noise levels of subsonic aircraft. Lattice Boltzmann equation (LBE) based simulations are attractive for CAA as they can handle very complex geometries and parallelize with excellent scalability. This enables efficient simulation of very large problems, such as airframe systems. The innovativeness of the proposed GLB method lies in employing multiple relaxation times to capture different hydrodynamic/acoustic modes accurately, in contrast to usual LBE solution methods using a single relaxation time for all modes. The GLB approach would enable higher fidelity CAA simulations as well as exhibit stability at higher Reynolds numbers. Multiple relaxation times can also enable represent turbulence better for large eddy simulation. In phase I, the feasibility of the GLB method will be evaluated by coding a 3D solver, including a subgrid scale turbulence model and multiblock grid refinement algorithms, with testing against several CAA benchmark problems. If successful, a validated package based on the GLB method interfaced to NASA pre/post processors, like CART3D, for complex geometries would be developed in Phase II.

Primary U.S. Work Locations and Key Partners
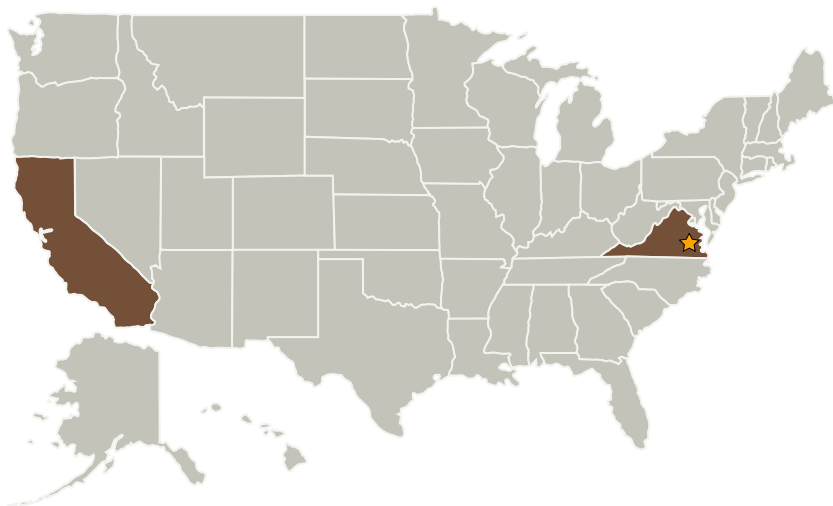
Computational Aeroacoustics Using the Generalized Lattice Boltzmann Equation, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Organizations Performing Work	Role	Type	Location
⭐Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
MetaHeuristics	Supporting Organization	Industry	Santa Barbara, California

Primary U.S. Work Locations	
California	Virginia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  └ TX15.1 Aerosciences
    └ TX15.1.3 Aeroelasticity

TechPort

Printed on 12/15/2022
12:44 AM UTC

For more information and an accessible alternative, please visit:
https://techport.nasa.gov/view/6132

Page 2